JAS-1 IS GO. 1.

This is the technical labo in JARL Hqs. in Tokyo. We will report you something about JAS-1 hereafter.

You can find the outline and also the schedule of JAS-1 in the attached paper.

Since 1983, the Project JAS-1 has started and Flight Model FM-1 was completed in March 1985, and FM-2 in November, skipping the process of the engineering model. FM-1 and 2 are now in the factory of NEC Corporation near Tokyo.

Transportation of FM-2 toward Tanegashima will start on 21st June, using a vehicle with air-suspended wheel, and many measuring and testing equipments accompany the satellite.

Tanegashima, the launching site is located in the southern part of Japan. Tanegashima (shima means island) is historically famous to Japanese people as the place the matchlock was brought in Japan for the first time by drifted Portuguese more than 400 years ago. At the same place, now we have the top-level firework.

NASDA's H-I (one) vehicle consists of two stages of rocket, and the propellant of the second stage is liquid oxygen and hydrogen. This vehicle is capable to throw payload of 1800 kilograms into orbit of 1500 kilometers altitude with inclination of 50 degrees.

This is the first flight of H-I, or the test flight. Instead of the dummy payload, three missions are prepared to be onboard H-I, they are: EGP, the experimental geodetic payload, JAS-1 and the magnetic bearing flywheel experiment.

About one hour after launch, the second stage rocket will come over the South American Continent, around where two payloads are separated from the rocket sequentially.

JAS-1 will be activated at the moment of separation, when the switch of power supply turns on. The first signal of JAS-1 will be heard by CEE (Centro de Estudios Espatiales) of University of Chile, of which staffs will provide us their assistance. About 20 minutes later, JAS-1 flying northward, will come to England, where the staffs of the University of Surrey will be waiting and check the health of the new born satellite.

JAS-1 will transmit only telemetry signal in CW, from the JA, or analog transponder, which you can hear the signals. During the initial period, we shall examine the satellite considering the solar condition, therefore, please do not use transponder until we announce the schedule.

(to be continued to the next)

* QST June, 1986 describes about JAS-1.

June 10, 1986

Major Specification of JAS-1

Launch and orbit

launch at	: August 1st, 1986, at 0530 JST, scheduled,
launch by	: H-I vehicle
launch from	: Tanegashima Space Center of NASDA, Japan
orbit	: circular, altitude of 1500 km
period	: 116 min.
inclination	: 50 degrees
life	: 3 years projected

Construction

weight	: 50 kg
configuration	: polyhedron of 26 faces covered in solar cells
size	: 400 mm (dia.) x 470 mm (height)
power generation	: 8 watt at the beginning of life

Communication subsystem

Analog (JA) and digital (JD) communication in mode J.

Transponders

analog transponder (linear transponder)

input frequency	:145.9-146.0 MHz (bandwidth 100 kHz)
output frequency	:435.9-435.8 MHz (inverted sideband)
reqd. uplink eirp	: 100 W
eirp of transponder	: 2 W pep

digital transponder

input frequency	: 4 channels of 145.85, 145.87, 145.89, 145.91 MHz
output frequency	: 435.91 MHz (1 ch)
reqd. uplink eirp	: 100 W
eirp of transponder	: 1 W rms
signal format	: 1200 baud PSK, store and foreward

beacon and telemetry

JA beacon	: 435.795 MHz, 100 mW CW or PSK
JD telemetry	:435.910 MHz, 1 W PSK

Orbit Parameters

epoch	: 1986-07-31, 21h 32m 07.20s UT,
semimajor axis	: 7879.562 km,
eccentricity	: 0.000140656,
inclination	: 50.0039 deg.,
R.A. of ascending node	: 237.456 deg.,
argument of perigee	: 2.155 deg.,
mean anomaly	:330.246 deg.

Schedule

time in JST

June 21 -	JAS-1 moves from Tokyo to Tanegashima
27	press release of all payloads
July 3	JAS-1 on attach fitting
7	JAS-1 on the middle section of the vehicle
14 -	middle section on stand
23	nose fairing closes
26	verification of launch
27	count down starts
August 1	launch

Revised

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JAS-1 IS GO   -2-

On 24th of June, Flight Model 2 of JAS-1 arrived at Tanegashima Space Center of NASDA, after a long trip. Flight Model 1 followed the FM-2 and both are now in the Center. The reason why we have brought both of the satellite is to make ready for changing satellite in case of emergency.

After JAS-1 will be successfully separated from the launch vehicle, it will transmit first, the beacon signal on 435.795 MHz from JA transponder, of course with some Doppler shift of frequency. So you can enjoy to receive the beacon signal and telemetry data on the beacon. The health of the satellite is checked by this telemeter data, and you can get the data reading the Morse code sent from the satellite.

The beacon contains the telemetry data in a format shown in Table 1. These data are sent by Morse code, beginning "HI HI" with a speed of about 100 characters every minute, and always in this format repeatedly. There are 30 items of data and 31 items of status in the telemetry of JAS-1 however, the beacon carries 12 data and most of status.

How to read telemetry:
In analog data from 1A through 3D, A, B, C and D express two digits of decimal value, for example, 123 for 1A, and 23 is a row data. Let this be N, for each item. True value or engineering data of each item is obtained by conversion shown in Table 2. And the reduced data will tend to converge to some definite values or range through operation of satellite for several months.

Status is expressed from 4A through 5D. Each character represents two digits of octal numbers, from 00 to 37. These are reduced to five digits of binary set. Each bit shows status of a set of five items in the order from MSB (Most Significant Bit) to LSB (Least Significant Bit).

An example will help you to understand. If the first item of status 4A were 423 for example, 4 should be removed, and 23 should be replaced by binary code (10011). This shows the status in the order of bit number from 4 to 0, that is, 1:Beacon is PSK, 0:Engineering data #2 is blank, 0:Engineering data #1 is blank, 1:JTD power is ON, 1:JTA power is ON. Expression of status goes like this to status No.40, every five status, and status is shown in Table 3. This expression is possible because all of the status have only two situations, ON/OFF or 1/2 and so on.

Figure 1 shows the expected orbits from the launch and for several rotations. The launch window will be limited within 2 hours, 0500 to 0700 JST or 2000 to 2200 UT of the pertinent day. JAS-1 will begin to transmit its beacon signal with telemetry described here, after separation from the launch vehicle above the South American Continent, and will first visit Europe.

At the initial period, JAS-1 will be operated only in analog mode. For digital operation, the preparation working is required and it will become available one or two months after the launch.

(to be continued to the next)

JAS-1 IS GO -3-

Now we are looking at Tanegashima launch site---we have already experienced putting-off of the scheduled launch twice, and it may happen even during delivery of this news. Postponed launch is now announced on and after 7th August, 2030 UT, as of July 25th.

The relating persons who are to go to Tanegashima at the time of the launch are making efforts how to reserve hotel rooms and how to get reservation of airplane seats, at every put-off of launch. This can happen frequently at every launch.

After separation of JAS-1 from the second stage of rocket, what orbit does JAS-1 take? Figure 1 shows planned orbits. Is it possible to determine JAS-1 orbit at every rotation? We have no observing network for orbit determination of JAS-1. Then, how can we obtain the orbit? One solution is to use the orbit of second stage rocket. JAS-1 is to be separated from the rocket by means of a spring force, however, this force is as strong as only to detach satellite very softly, and speed of separation from the rocket is about 70 cm per second, or 0.01% of flying velocity. This means the orbit of JAS-1 is almost represented by that of the second stage rocket flying together.

The second stage rocket bears one of the mission payloads, or the experimental magnetic bearing flywheel. Therefore, the rocket transmits telemetry signal and this will enable to determine its orbit by NASDA network. This will be available for three or four days, until the battery on board rocket shall exhaust its power. Through this method, the prediction of orbit will be possible with small error.

Another way is the prediction by means of Doppler shift curve. It may be possible to estimate the orbit by observing Doppler shift frequency with time. Plotting these data on a paper, we can draw a drift curve of Doppler shift and this is compared with many prepared drift curves of Doppler shift, and well-fitted curve is chosen out of them, which shows the relating parameters of orbit. This method requires already prepared drift curves for the location of the observing station. The prepared drift curves are drawn by changing every orbit parameters little by little, that results a large number of curves for the location of the observing station.

After a while, a precise orbit parameters will be issued from NASA that we can use. This will be also distributed widely.

When JAS-1 obtained the scheduled orbit, you can find the succeeding orbit in the Figure 1, showing that the possibility to meet JAS-1 is large in Europe, North America and Australia, at earlier orbit. In Japan, we will be able to access to JAS-1 from 7th orbit.

When JAS-1 is coming within your view, you can receive JA beacon signal on 435.795 MHz.

Frequency of 435.795 MHz is nominal, and you cannot get any signal if you are waiting with your rig tuned on this frequency. The satellite is

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When JAS-1 is coming within your sight, you can receive 1W beacon signal on 435.795 MHz.

Frequency of 435.795 MHz is nominal, and you cannot get any signal if you are waiting with your rig tuned on this frequency. The satellite is

moving with peripheral speed of about 7 km/sec, therefore so-called Doppler shift of frequency will occur. When the transmitter working on 435 MHz is moving toward the fixed receiver with speed of 7 km/sec, apparent receiving frequency will increase by a deviation of [(7 km/s)/(velocity of light)] x 435 MHz, or about 10 kHz. This value is the maximum when the receiver is on the line of motion, and the deviation decreases as the receiver goes apart from this line. When the transmitter moves away from the receiver, deviation is vice versa.

Now, you should tune your rig a little bit higher than 435.795 MHz, waiting AOS (Aquisition Of Signal) of JAS-1. "a little bit"---how much? Yes, precisely, it is according to the orbit of satellite. If you get tuned in the signal frequency, you should track the frequency by shifting down the receiving frequency manually, when the satellite is approaching.

For the orbit of maximum elevation of 10 degrees at TCA, the deviation at around AOS is about 4700 Hz, for 30 degrees, 6800 Hz and for 60 degrees deviation will be about 7700 Hz. Frequency drift curves for each case are shown in Figure 2.

At the time of the closest approach (TCA) to the receiver, frequency deviation becomes zero, or the received frequency becomes nominal value. After that the process will go invertedly, until LOS (Loss Of Signal). For these procedure, bulletins and news reporting forecast data will help you to access to the satellite.

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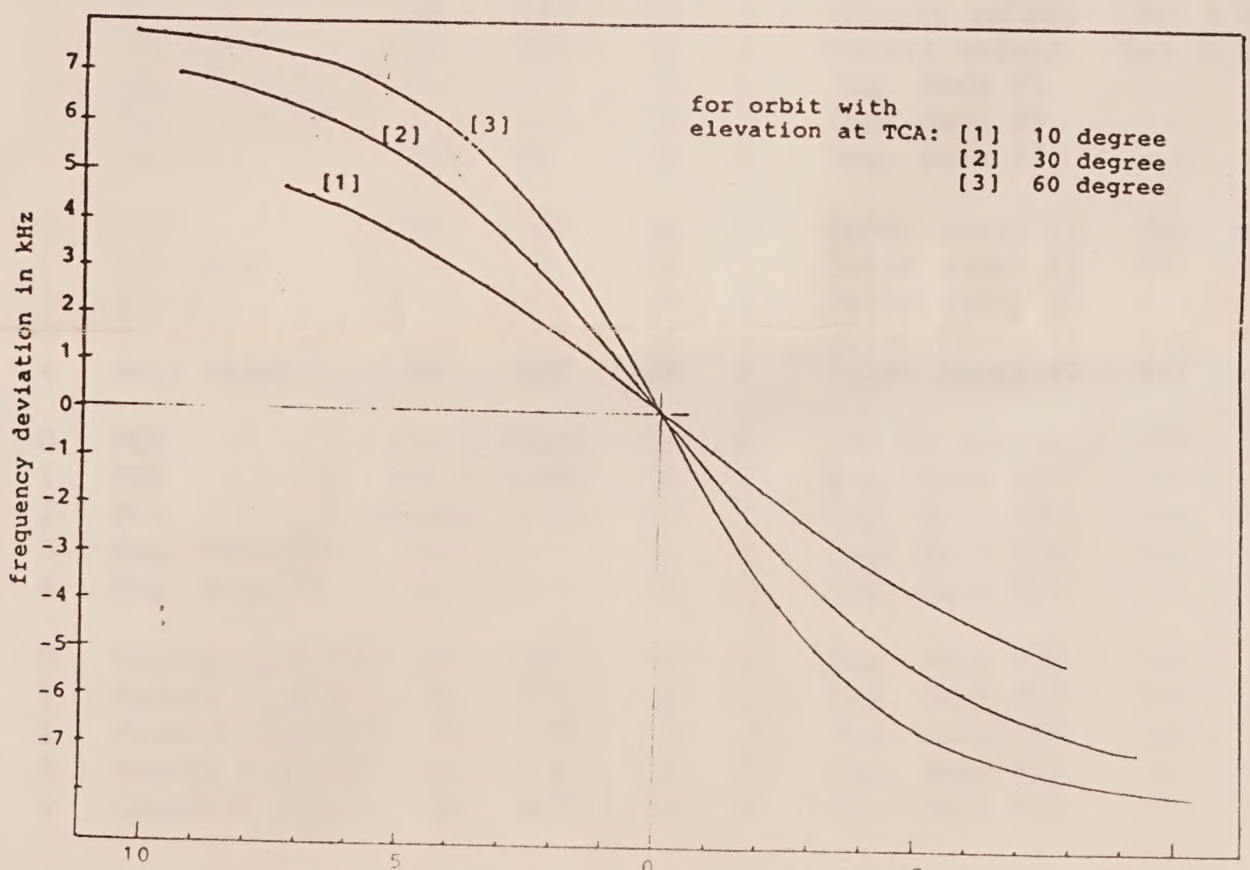


Figure 2, lapse of time from AOS to LOS, in minute

Revised.

Table 1

HI	HI	1A	1B	1C	1D	2A	2B	2C	2D	3A	3B	3C	3D	4A	4B	4C	4D

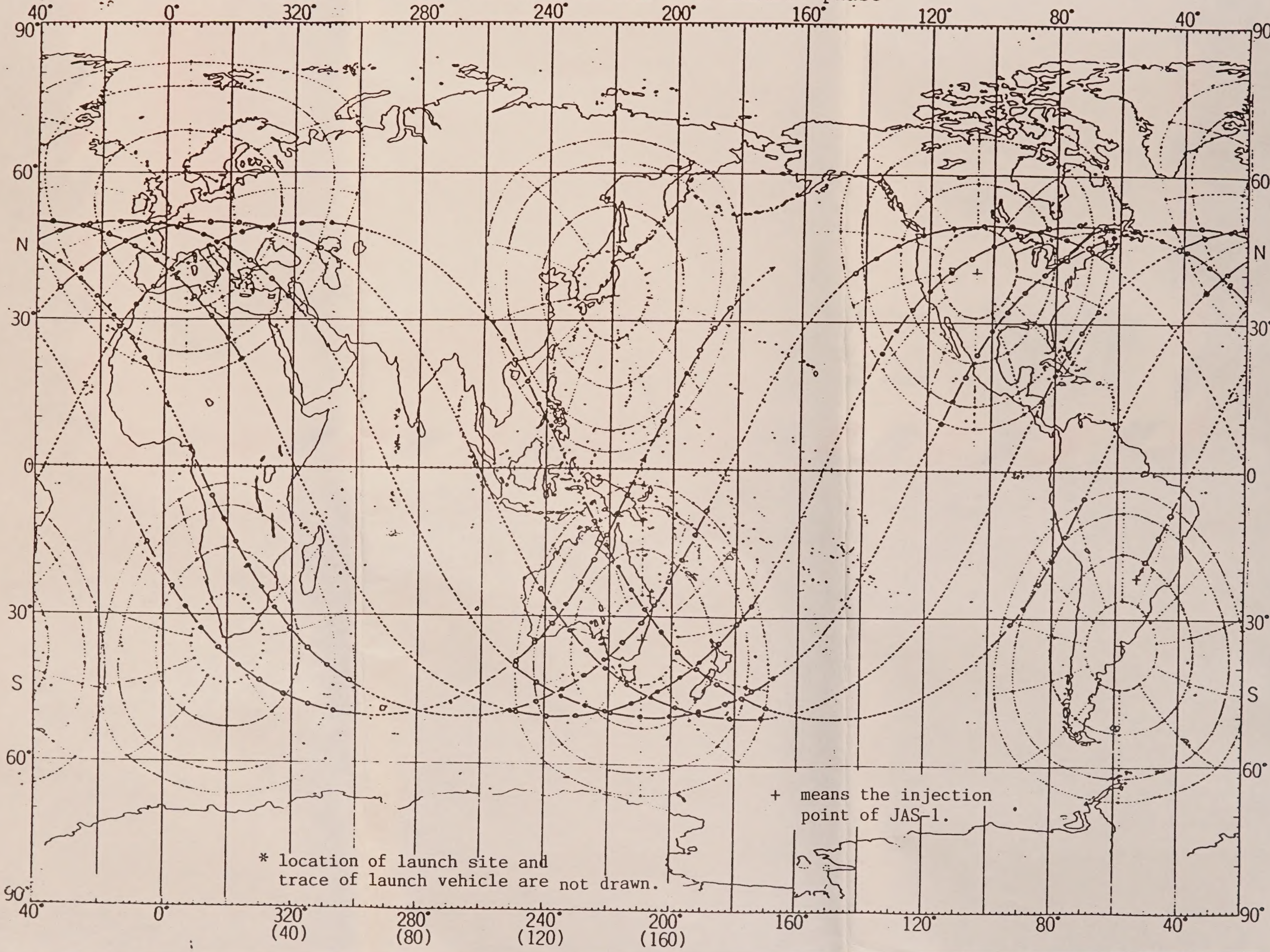
Table 2, Conversion of analog telemetry

	Item	Conversion formula
1A	current of solar cells, 0-2 A	I = 19.1 x (N - 0.4) mA.
1B	charge/discharge current of battery, -2 to +2 A	I = 38.1 x (N - 26.4) mA.
1C	terminal voltage of battery, 0-20 V	V = (N/100) x 21.0 V.
1D	center-tap voltage of battery, 0-10 V	V = (N/100) x 9.37 V.
2A	bus voltage, 0-20 V	V = (N/100) x 19.2 V.
2B	regulated voltage +5 V, 0-7.5 V	V = (N/100) x 5.72 V.
2C	output power of JTA, 0-3 W	P = 51 x (N - 15.8) mW.
2D	calibration voltage, 0-2 V	V = N/50 V.
3A	temperature of battery cell, -50 to +70 degree C.	
3B	temperature of baseplate 1	
3C	dit. 2	temperature is reduced as
3D	dit 3	T = 1.39 x (68.9 - N) degree C.

Table 3, System status

ch.	bit	item	1	0	ch.	bit	item	1	0
4A	0	JTA power	ON	OFF	5A	0	Memory select	bit 1	(LSB)
4A	1	JTD power	ON	OFF	5A	1	Memory select	bit 2	(MSB)
4A	2	Eng. data #1	---	---	5A	2	Eng. data #5	---	---
4A	3	Eng. data #3	---	---	5A	3	Eng. data #6	---	---
4A	4	Beacon	PSK	CW	5A	4	Eng. data #7	---	---
4B	0	UVC	ON	OFF	5B	0	Solar panel #1	day	night
4B	1	UVC level	1	2	5B	1	Solar panel #2	day	night
4B	2	Battery	tric	full	5B	2	Solar panel #3	day	night
4B	3	Battery logic	tric	full	5B	3	Solar panel #4	day	night
4B	4	Main relay	ON	OFF	5B	4	Solar panel #5	day	night
4C	0	PCU	bit 1	(LSB)	5C	0	JTA CW beacon	CPU	TLM
4C	1	PCU	bit 2	(LSB)	5C	1	Eng. data #8	---	---
4C	2	PCU	manual	auto	5C	2	Eng. data #9	---	---
4C	3	Eng. data #3	---	---	5C	3	Eng. data #10	---	---
4C	4	Eng. data #4	---	---	5C	4	Eng. data #11	---	---
4D	0	Memory bank #0	ON	OFF	5D	0	Eng. data #12	---	---
4D	1	Memory bank #1	ON	OFF	5D	1	Eng. data #13	---	---
4D	2	Memory bank #2	ON	OFF	5D	2	Eng. data #14	---	---
4D	3	Memory bank #3	ON	OFF	5D	3	Eng. data #15	---	---
4D	4	Computer power	ON	OFF	5D	4	Eng. data #16	---	---

Figure 1, Scheduled orbit of JAS-1 at initial phase



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